

## OPTIMIZATION OF THE SALANGANES' NEST DRINKS COMPOSITION

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## ABSTRACT

Bird's Nest is a famous food with high nutritional value and health benefits, so this article focuses on optimizing the composition of antioxidant drinks from bird's nests. Ingredients of beverages such as Bird's Nest Essence (20-30%), *Ginkgo biloba* (0.1-0.3%), Chamomile (0.1-0.3%), and Glucosamine (0.3-0.9%) are studied and optimized. The target functions were sensory characteristics, brix degree, and reducing power activity with 25 experiments and triplication three times. The results showed that the highest sensory point, Brix degree, and reducing power capacity were 18.88, 9.4, and 1.2, respectively, with 24.79% of bird's nest essence, 0.18% of *Ginkgo biloba*, 0.23% of Chamomile, and Glucosamine of 0.8%. Lack of fit of target functions was non-significance in statistics ( $p > 0.05$ ). The adjusted  $R^2$  of models was over 0.8 exhibiting the high correlation between input factors and target functions. The bird's nest beverage could be fully deployed on an industrial scale.

**KEYWORDS:** Knowledge; attitude; utilization; barriers; emergency contraceptive.

## INTRODUCTION

According to many sources, Salanganes'Nest was processed by the Chinese 400 years ago. The bird nests in a cave, and Chinese, the word cave is read closely as the word pole - it can be easier to understand with the word den (cave: 燕窩). In Chinese, the "pole" corresponds to a bird's nest. Thus, the "Sao" mean Salanganes'Nest. Therefore, when exploiting the nest in the cave, people call it the bird's nest or the nest itself.<sup>[1,2]</sup>

Salanganes'Nest appeared in Vietnam during the reign of King Tu Duc. During this period, Salanganes'Nest was brought into the palace by mandarins, offered to the king, and became a royal dish. Over thousands of years, to this day, Salanganes 'Nest still holds a high value. Nowadays, Salanganes'Nest is more popular and used in families with economic conditions and is much more diverse such as bird's nest soup, bird's nest with chicken, nest with lotus seed stew, and bird's nest porridge with chicken.<sup>[3,4]</sup>

Bird's nest is a rich resource of essential amino acids, glycoprotein, trace elements, elastin, sialic acid, triacylglycerol, vitamins, lactoferrin, fatty acids, and glucosamine.... Salanganes'Nest possesses other bioactivities such as antioxidant, neuroprotection, treating tuberculosis, dry coughs, asthma, gastric trouble and stomach ulcer, a pair of strong lung.<sup>[5-8]</sup>

Therefore, this study focused on optimizing the antioxidant bird's nest beverage formula.

## MATERIALS AND METHODS

## Materials

Base materials: Walocel, Xanthan gum, refined sugar, rock sugar, Stevia, flavoring.

Additional and active ingredients: Bird's nest essence, *Ginkgo biloba*, *Chamomile*, *Glucosamine*, Aboromase (East Gonja Municipal Health Directorate, 2022).

## Sensory evaluation

Sensory valuation of product was according to TCVN 3215-79.<sup>[9]</sup>

## Determination of Brix degree

Determination of Brix degree was by test method of TCVN 4414:1987.<sup>[10]</sup>

## Quantification of microorganisms

Determination of total aerobic microorganisms, Coliforms, *Escherichia coli*, Salmonella, *Clostridium perfringens*, and *Staphylococcus aureus* was according to ISO 4833- 1:2013, ISO 4832: 2006, ISO 7251:2005, ISO 6579:2002, ISO 7937:2004, and ISO 6888-3:2003, respectively.

## Quantification of heavy metal content

The content of cadmium, lead, and mercury was according to AOAC 999.11, AOAC 999.11, and AOAC 971.21.

## Total antioxidant activity

The total antioxidant activity was determined by the Prieto method.<sup>[11]</sup> 1 ml of the sample added 0.5 ml of

water with 03 ml of the reaction solution (0.6 M sulfuric acid, 28 mM sodium sulfate and 04 mM ammonium molybdate) at 95 °C for 90 min. Measurement of the reaction mixture was at 695 nm with ascorbic acid as the standard.

**Experiment design**

The base material mixture is mixed with the heated water (70 ± 2°C), continuously heated to 100°C, and stirred to

form a homogeneous mixture. Continuously, the filtrate was obtained from a homogeneous mixture. The mixture added to the additional and active ingredients and vortexed well, conduct heat treatment to remove microorganisms. Then, pour the product solution into the appropriate packaging. Sample was designed according to the Table 1 and 2.

**Table 1. Actual and code variant in optimization design according to the central composite.**

Sr.No	Active ingredients	Code variant	Unit	Below level -1	Basic level 0	Upper level +1
1	Essence of bird's nest	Z <sub>1</sub>	%	20	25	30
2	<i>Ginkgo biloba</i>	Z <sub>2</sub>	%	0.1	0.2	0.3
3	<i>Chamomile</i>	Z <sub>3</sub>	%	0.1	0.2	0.3
4	<i>Glucosamine</i>	Z <sub>4</sub>	%	0.3	0.6	0.9

**Table 2: Experiment design for optimization of beverage composition.**

Experi_ ment	Essence of bird's nest Z1 (%)	Ginkgo biloba Z2 (%)	Chamomile Z3 (%)	Glucosamine Z4 (%)	Target function Yi (1-3)
1	-1	-1	-1	-1	
2	1	-1	-1	-1	
3	-1	1	-1	-1	
4	1	1	-1	-1	
5	-1	-1	1	-1	
6	1	-1	1	-1	
7	-1	1	1	-1	
8	1	1	1	-1	
9	-1	-1	-1	1	
10	1	-1	-1	1	
11	-1	1	-1	1	
12	1	1	-1	1	
13	-1	-1	1	1	
14	1	-1	1	1	
15	-1	1	1	1	
16	1	1	1	1	
17	-1	0	0	0	
18	1	0	0	0	
19	0	-1	0	0	
20	0	1	0	0	
21	0	0	-1	0	
22	0	0	1	0	
23	0	0	0	-1	
24	0	0	0	1	
25	0	0	0	0	

**Data analysis**

The primary data were analyzed using MS. Excel 2013. Removal unusual value was by method Duncan. Experiments were triplicated and exhibited under mean ± standard deviation. Data optimization was by MODDE 5.0.

**RESULTS AND DISCUSSION**

**Effect of proportion of additional ingredients and active ingredients on sensory value**

Perceived value is one of the necessary factors in the perceived value of customers for new products, the

perceived value of customers plays a positive role in creating brand value and also represents the The customer's price for the product, influenced by the proportion of ingredients, active ingredients added to the prototype, plays a decisive role in the final product. The adjusted R2 coefficient in the model is 0.908, which means that the influence of 04 factors (Salanganes nests essence, Ginkgo biloba, Chamomile, and Glucosamine) on the sensory value is 90.8% and 9.2%, respectively.

Product is caused by factors other than the model. The lack of fit coefficient means that the errors in different

software are not statistically significant. This coefficient must be greater than 0.05 ( $p > 0.05$ ) to be able to ignore the error in the software system (because the error is not significant). The lack of fit coefficient of the design

model is 0.281, which is greater than 0.05, so we can assume that the errors in the software system are insignificant. These errors can be ignored.

**Table 3. The results of optimization for bird’nest beverage compositions.**

Experiment	Essence of bird's nest Z1 (%)	Ginkgo biloba Z2 (%)	Chamomile Z3 (%)	Glucosamine Z4 (%)	Sensory	Brix (%)	Total antioxidant activity (mg AA/ml solution)
1	-1	-1	-1	-1	17.47 ± 0.06	17.47 ± 0.06	17.47 ± 0.06
2	1	-1	-1	-1	17.27 ± 0.05	17.27 ± 0.05	17.27 ± 0.05
3	-1	1	-1	-1	17.36 ± 0.09	17.36 ± 0.09	17.36 ± 0.09
4	1	1	-1	-1	17.39 ± 0.38	17.39 ± 0.38	17.39 ± 0.38
5	-1	-1	1	-1	17.83 ± 0.05	17.83 ± 0.05	17.83 ± 0.05
6	1	-1	1	-1	17.45 ± 0.08	17.45 ± 0.08	17.45 ± 0.08
7	-1	1	1	-1	17.68 ± 0.09	17.68 ± 0.09	17.68 ± 0.09
8	1	1	1	-1	17.63 ± 0.15	17.63 ± 0.15	17.63 ± 0.15
9	-1	-1	-1	1	18.19 ± 0.18	18.19 ± 0.18	18.19 ± 0.18
10	1	-1	-1	1	18.29 ± 0.16	18.29 ± 0.16	18.29 ± 0.16
11	-1	1	-1	1	18.00 ± 0.05	18.00 ± 0.05	18.00 ± 0.05
12	1	1	-1	1	18.03 ± 0.09	18.03 ± 0.09	18.03 ± 0.09
13	-1	-1	1	1	18.31 ± 0.17	18.31 ± 0.17	18.31 ± 0.17
14	1	-1	1	1	18.19 ± 0.06	18.19 ± 0.06	18.19 ± 0.06
15	-1	1	1	1	18.13 ± 0.21	18.13 ± 0.21	18.13 ± 0.21
16	1	1	1	1	18.07 ± 0.03	18.07 ± 0.03	18.07 ± 0.03
17	-1	0	0	0	18.38 ± 0.09	18.38 ± 0.09	18.38 ± 0.09
18	1	0	0	0	18.27 ± 0.15	18.27 ± 0.15	18.27 ± 0.15
19	0	-1	0	0	18.52 ± 0.33	18.52 ± 0.33	18.52 ± 0.33
20	0	1	0	0	18.58 ± 0.05	18.58 ± 0.05	18.58 ± 0.05
21	0	0	-1	0	18.78 ± 0.16	18.78 ± 0.16	18.78 ± 0.16
22	0	0	1	0	18.7 ± 0.20	18.7 ± 0.20	18.7 ± 0.20
23	0	0	0	-1	18.19 ± 0.18	18.19 ± 0.18	18.19 ± 0.18
24	0	0	0	1	18.9 ± 0.07	18.9 ± 0.07	18.9 ± 0.07
25	0	0	0	0	18.59 ± 0.16	18.59 ± 0.16	18.59 ± 0.16

The coefficient of adjust  $R^2$  in the model is 0.908, which means that the influence of 04 factors Salanganes nests essence, *Ginkgo biloba*, Chamomile, Glucosamine on the sensory value is 90.8% and 9.2%, respectively. product is caused by factors other than the model.

The lack of fit coefficient means that the errors in different software are not statistically significant. This coefficient must be greater than 0.05 ( $p > 0.05$ ) to ignore the error in the software system (because the error is not significant). The lack of fit coefficient of the design model is 0.281, which is greater than 0.05, so we can assume that the errors in the software system are negligible, these errors can be ignored.

The regression analysis showed that the coefficient  $R^2$  (actual variability) is 0.925 and  $Q^2$  (imaginary variability) is 0.885, proving that the obtained model is

significant and compatible with reality. The closer the  $R^2$  and  $Q^2$  values are to 1, the higher the confidence level of the regression model, which shows that the correlation between the percentage of additional ingredients and active ingredients is almost significant with 95% confidence ( $p < 0.05$ ).

According to the results showing the influence of the optimization factors, it was found that the elements Bird's nest essence ( $Z_1$ ), *Ginkgo biloba* ( $Z_2$ ), Chamomile ( $Z_3$ ), and Glucosamine ( $Z_4$ ) all affect average sensory value.

The quadratic coefficient of Salanganes'Nest Essence and Chamomile exhibit the greatest and the lowest influence on sensory value, respectively. In addition, the interaction between the variables  $Z_1$ ,  $Z_2$ ,  $Z_3$ ,  $Z_4$  also affects the sensory value.

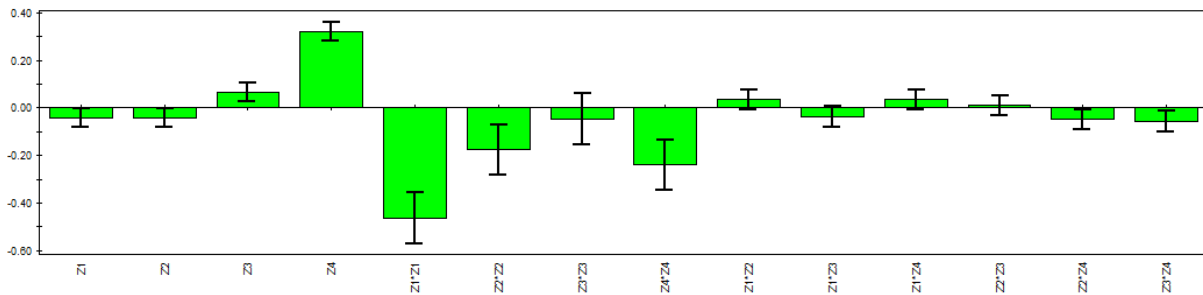


Fig 1: The coefficient of variation of the influencing factors.

Using MODDE 5.0 software, the coefficients of the objective function have been calculated, after removing the non-significant coefficients that the computer has calculated, the objective function follows the quadratic orthogonal model of the objective function. The optimal ratio of additional ingredients and active ingredients of sensory value has the form.

$$Y = 18.759 - 0.0425Z_1 - 0.0425Z_2 + 0.0666Z_3 + 0.3229Z_4 - 0.4632Z_{12} - 0.1765Z_{22} - 0.0465Z_{32} - 0.2399Z_{42} + 0.0341Z_1Z_2 - 0.0366Z_1Z_3 + 0.0341Z_1Z_4 + 0.0099Z_2Z_3 - 0.0491Z_2Z_4 - 0.0566Z_3Z_4$$

From the regression equation, it is found that the coefficients of quadratic variables are all less than 0, that is, the sensory value will increase when these variables increase to a certain extent, then decrease gradually according to the two-sided rule.

Accordingly, the optimal conditions are: Z<sub>1</sub> = 24.79%, Z<sub>2</sub> = 0.18%, Z<sub>3</sub> = 0.23%, Z<sub>4</sub> = 0.8%, will achieve a sensory value of 18.88.

**Effect of the ratio of ingredients and active ingredients on the Brix value**

Brix values that create product characteristics through sensory values and are influenced by independent

variables composed of Bird's nest essence, Ginkgo biloba, Chamomile, and Glucosamine.

The adjusted R<sup>2</sup> coefficient in the model is 0.860, which means that the influence of 04 factors Salanganes nests essence, Ginkgo biloba, Chamomile, Glucosamine on Brix value is 86% and 14% due to the impact of these factors. factors other than the model.

The lack of fit coefficient means that the errors in different software are not statistically significant. This coefficient must be greater than 0.05 (p>0.05) to ignore the error in the software system (because the error is not significant). The lack of fit coefficient of the design model is 0.520, which is greater than 0.05, so we can assume that the error in the software system is insignificant, the errors can be ignored. The results of the regression analysis showed that the coefficient R<sup>2</sup> (real variability) is 0.887 and Q<sub>2</sub> (imaginary variability) is 0.826, proving that the obtained model is meaningful and highly compatible with reality. The closer the R<sup>2</sup> and Q<sub>2</sub> values are to 1, the higher the confidence level of the regression model, which shows that the correlation of the percentage of additional ingredients and active ingredients is almost significant with 95% confidence (p<0.05).

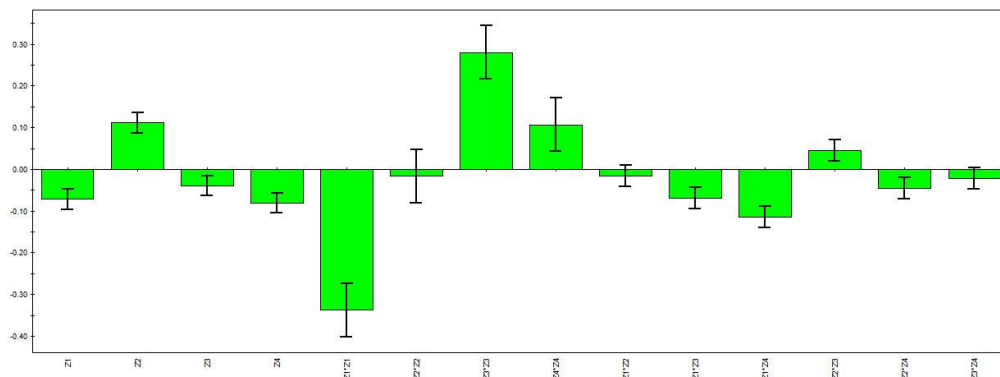


Fig 2: The coefficient of variation of the influencing factors.

According to the results showing the influence of the optimization factors, we found that the elements Bird's nest essence (Z<sub>1</sub>), Ginkgo biloba (Z<sub>2</sub>), Chamomile (Z<sub>3</sub>) and Glucosamine (Z<sub>4</sub>) all have an influence. affect the Brix value. In which, the quadratic coefficient of Salanganes'Nest Essence has more influence on Brix value than Ginkgo biloba. In addition, the interaction

between the variables Z<sub>1</sub>, Z<sub>2</sub>, Z<sub>3</sub>, Z<sub>4</sub> also has an effect on the Brix value. Using the software MODDE 5.0 calculated the coefficients of the objective function. After removing the non-significant coefficients that the computer had statistic, the objective function changed to the quadratic model of the ratio of the optimal

supplemental ingredients and active ingredients of the Brix value in the form of.

$$Y = 9,4196 - 0,0716Z_1 + 0,1114Z_2 - 0,0399Z_3 - 0,0807Z_4 - 0,3379Z_{12} - 0,0162Z_{22} + 0,0823Z_{32} + 0,1070Z_{42} - 0,0152Z_1Z_2 - 0,0693Z_1Z_3 - 0,1139Z_1Z_4 + 0,0447Z_2Z_3 - 0,0464Z_2Z_4 - 0,0222Z_3Z_4$$

The highest sensory value of 18.88 and Brix value of 9.4 corresponded to Bird's Nest essence of 24.79%, and Ginkgo biloba of 0.18. %, Chamomile of 0.23%, and Glucosamine of 0.8%.

**Effect of the ratio of raw materials and active ingredients on antioxidant activity**

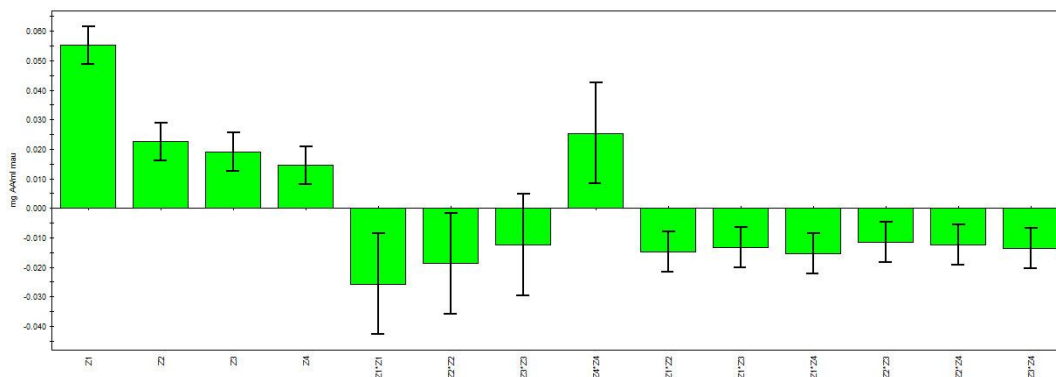
The adjusted R<sup>2</sup> coefficient in the model is 0.875, which means that the influence of 04 factors Salanganes nests essence, Ginkgo biloba, Chamomile, Glucosamine to the total reduction capacity is 87.5% and 12.5% respectively. effects of factors other than the model.

The lack of fit coefficient means that the errors in different software are not statistically significant. This coefficient must be greater than 0.05 (p>0.05) to ignore the error in the software system (because the error is not significant). The lack of fit coefficient of the design model is 0.253, which is greater than 0.05, so we can assume that the errors in the software system are negligible, these errors can be ignored.

The results of the regression analysis show that the coefficient R<sup>2</sup> (real variation) is 0.898 and Q<sup>2</sup> (imaginary variation) is 0.842 and the confidence level is 95% (p<0.05), proving that the obtained model has meaningful and compatible with high reality.

According to the results showing the influence of the optimization factors, we find that the coefficient of first-order variable decreases from Bird's nest essence (Z<sub>1</sub>) > Ginkgo biloba (Z<sub>2</sub>) > Chamomile (Z<sub>3</sub>) > Glucosamine (Z<sub>4</sub>) both had an effect on the total reduction capacity. In particular, bird's nest essence has a great influence on the total reduction capacity, meaning that the higher the concentration of bird's nest essence, the stronger the total reduction capacity. In addition, the reciprocal interaction between the variables Z<sub>1</sub>, Z<sub>2</sub>, Z<sub>3</sub>, Z<sub>4</sub> also has an effect on the total reduction capacity. Using MODDE 5.0 software, the coefficients of the objective function have been calculated, after removing the non-significant coefficients that the computer has statistic, the objective function follows the quadratic orthogonal model of the objective function. The optimal ratio of additional ingredients and active ingredients of total reduction capacity has the form.

$$Y = 1.1831 + 0.10552Z_1 + 0.0225Z_2 + 0.019Z_3 + 0.0145Z_4 - 0.0256Z_{12} - 0.0186Z_{22} - 0.0123Z_{32} + 0.0254Z_{42} - 0.0147Z_1Z_2 - 0.0133Z_1Z_3 - 0.0154Z_1Z_4 - 0.0115Z_2Z_3 - 0.0124Z_2Z_4 - 0.0137Z_3Z_4$$



**Fig 3: The coefficient of variation of the influencing factors.**

The highest sensory value of 18.88 and the total reducing capacity of 1.2 corresponded to Salanganes'Nest Essence at 24.79%, Ginkgo biloba at 0.17%, Chamomile at 0.23%, and Glucosamine at 0.8%. The product is studied to add bird's nest essence and good nutritional active ingredients with the ability to be antioxidant, strengthen the immune system, improve bones and joints, eat well, and sleep well.

Consuming natural antioxidants will reduce the amount of “bad” LDL cholesterol, which is a mainly cause of heart disease. The cell damage caused by free radicals will also affect heart health due to the oxidation of cholesterol. There is too much cholesterol in the blood, it will lead to the accumulation of plaque in the arteries, leading to atherosclerosis, from which the blood flow to the heart muscle is blocked and degrees.<sup>[12]</sup> Antioxidants

are thought to be able to reduce the risk and damage caused by oxidative stress to the body. Antioxidants can act as radical reducing, hydrogen electron donor, peroxide degrading, single oxidizing agent, enzyme inhibitor, synthesizing and metal chelating agent. Antioxidant supplements can help reduce vision loss caused by macular degeneration.

Meanwhile, bird's nest is rich in antioxidants, such as amino acids, sialic acid, triacylglycerol, vitamins, lactoferrin, fatty acids, minerals, and glucosamine.<sup>[13]</sup> The results of this study also show that bird's nest beverage possesses high antioxidant activity. Bird's Nest beverages could play a positive role in antioxidants and improve the immune system of customers.

In fact, numerous studies on the development of antioxidant beverages and their bioactive were noticed.<sup>[14-17]</sup> Nest soup-consumed Chinese pregnant women improved skin infant skin complexion.<sup>[16]</sup> Furthermore, bone strengthening, anti-virus, erythrocyte agglutinin inhibitors<sup>[17]</sup>, and anti-aging maintaining youthful and radiant skin<sup>[18]</sup> were improved in bird Nest-used consumers. Birds Nest has also been added to cosmetic products to rejuvenate new skin cells. Formulation of edible bird nest-based instant soup was optimized by response surface method. The current study on composition optimizing antioxidant bird's nest drinks from Vietnamese island nests was noticed.

## CONCLUSION

This study optimized the beverage formula containing the ingredients (Bird's Nest Essence, Ginkgo biloba, Chamomile, and Glucosamine). The highest sensory point (18.88 points), Brix degree (9.4), and reducing power capacity (1.2 mg ascorbic acid/mL) were found at the optimization condition (24.79% of bird's nest essence, 0.18% of Ginkgo biloba, 0.23% of Chamomile, and Glucosamine of 0.8 %). Target functions were non-significance in statistics for lack of fit ( $p > 0.05$ ). The adjusted  $R^2$  of the models was over 0.8. A high correlation between input factors and target functions was shown. Bird's nest beverage is potential for human health.

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